Effect of single-walled carbon nanotubes over the efficiency of the protective garment against diagnostic x-ray

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INTRODUCTION

Nanotechnology has become to fascinating issue for radiation protection researchers. Finding an alternative for common protective garment was necessary due to its problems associated with. Hence, many studies have shown that nanoparticles have been capable against x-rays related to diagnostic radiology. On the other hand, single-walled carbon nanotubes (SWCNTs) in nanocomposites made it lighter and more strength (1). The purpose of this study was to investigate the effect of single-wall carbon nanotubes on protective garment efficiency against diagnostic radiology energies.

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METHOD

- polydimethylsiloxane-based (PDMS) nanocomposites were fabricated by mixing solution procedure with Cerium Oxide nanoparticles (nanoceria) and SWCNT as filler.
- Nanomaterials were characterized (Fig 1) by Field Emission Scanning Electron Microscope (FE-SEM).
- Specimens were characterized by Fe-SEM and Fourier Transform Infrared Spectroscopy (FT-IR) test.
- The nanocomposites were exposed by a diagnostic X-ray apparatus at energies 60, 80, 100, and 120 kVp (2,3).
- X-Ray attenuation characteristics were measured with Piranha red dosimeter at narrow beam geometry

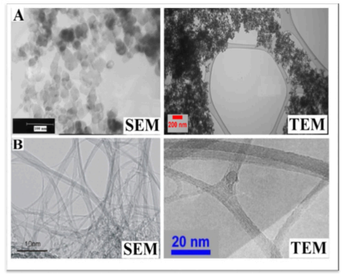

Fig 1. nanomaterial images for A) nanoceria, B) SWCNT

RESULTS

The FE-SEM images exhibiting the uniform dispersion (Fig 2), and FT-IR dates confirmed nanocomposite characteristics (Fig 3). The nanocomposite attenuation was between 5-12% for SWCNTs to that were reinforced with nanoceria (Fig 4). Interestingly, its mass thickness was less than 12% of nanocomposite reinforced with nanoceria (Fig 5).

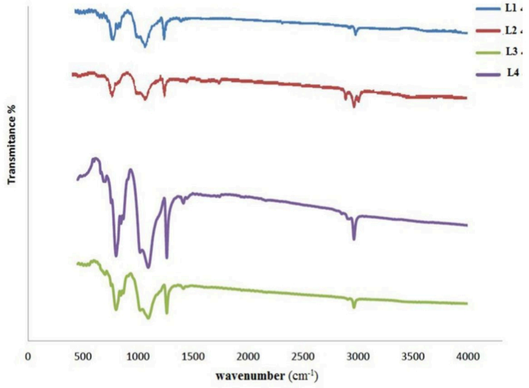

Fig 3. FT-IR spectrum of nanocomposites

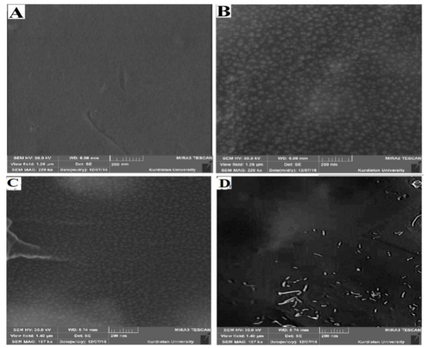

Fig 2. FE-SEM of nanocomposites A) L1 (PDMS), B) L3 (25% wt nanoceria), C) L4 (25%wt nanoceria + 2% wt SWCNT), D) L2 (2%wt SWCNT)

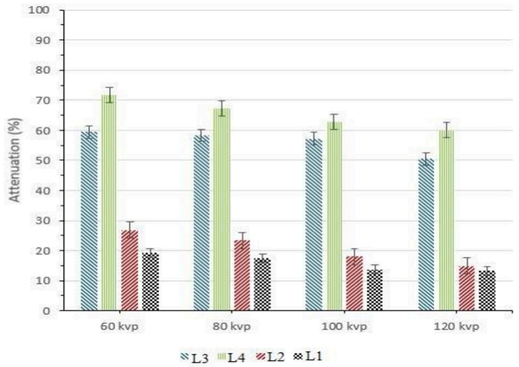

Fig 4. compression of nanocomposites attenuation at different X-rays quality

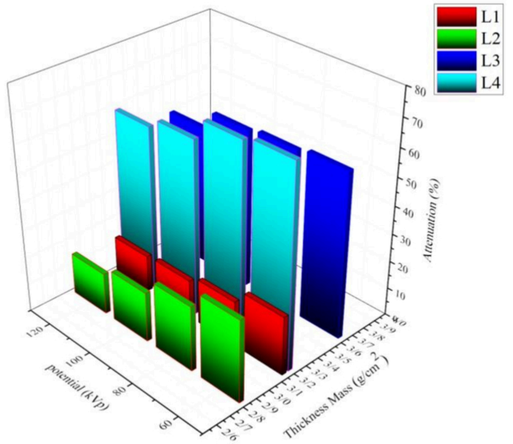

Fig 5. The amount of attenuation in terms of the mass thickness of different samples in the four studied energies.

CONCLUSIONS

The results of this study indicated that SWCNT can be improved efficiency of radiation protection garment both in terms of weight and attenuation capability.

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